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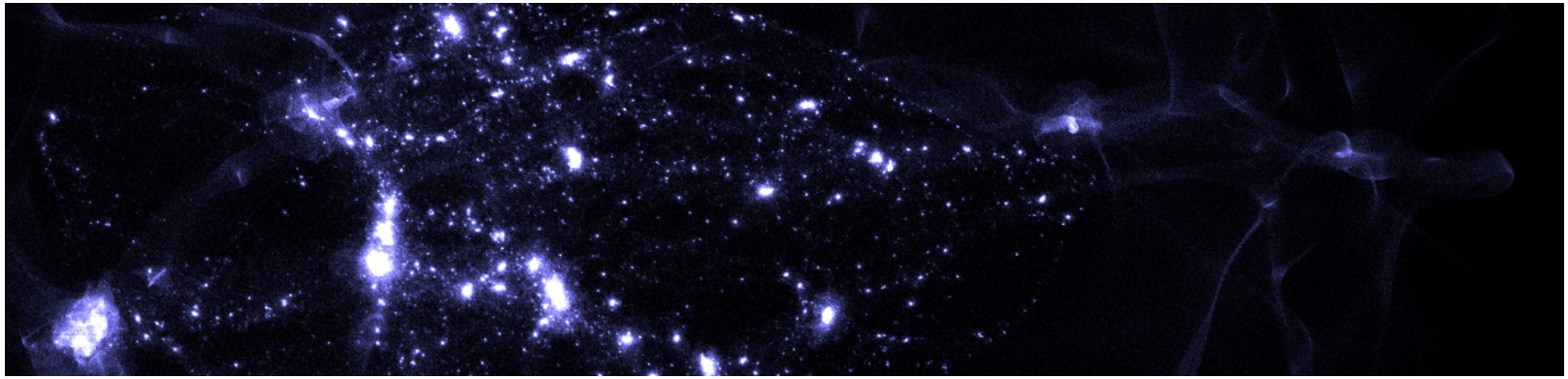

WITHOUT INSIGHT -- VISUALISATION WOULD ONLY BE DESIGN

INVITATION

We cordially invite you to join us for **OzViz 2012**. This year the workshop will be held from **6th-7th December 2012** in **Perth, WA**. A co-located **Accelerated Computing Workshop** will be held **December 5th** at the same venue.

BACKGROUND

Started in 2001, **OzViz** is one of the premier annual workshops for visualisation practitioners, academics and researchers across Oceania, especially Australia and New Zealand.

WORKSHOP

The workshop provides an informal opportunity for participants to present research outcomes, share innovative ideas, publicise work and meet colleagues. It is a very multidisciplinary event, with participants from many fields such as mathematics, geoscience, architecture, biology, medicine and astronomy presenting alongside computer graphics and visualisation experts.

LOCATION

The workshop will be held at the University of Western Australia, on the main Crawley Campus just outside the Perth CBD. All talks and presentations will be done in the **Bayliss Building, Theatre G33** on the **6th-7th of December** from 8am - 5pm.

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VENUE

The workshop will be held at the University of Western Australia, on the main Crawley Campus just outside the Perth CBD. All talks and presentations will be done in the **Bayliss Building, Theatre G33** from the **6th-7th December** from 8am - 5pm.

The **Accelerated Computing Workshop** will be held in the same room the day before **OzViz** -- the **5th of December** from 8am - 5pm.

DINNER

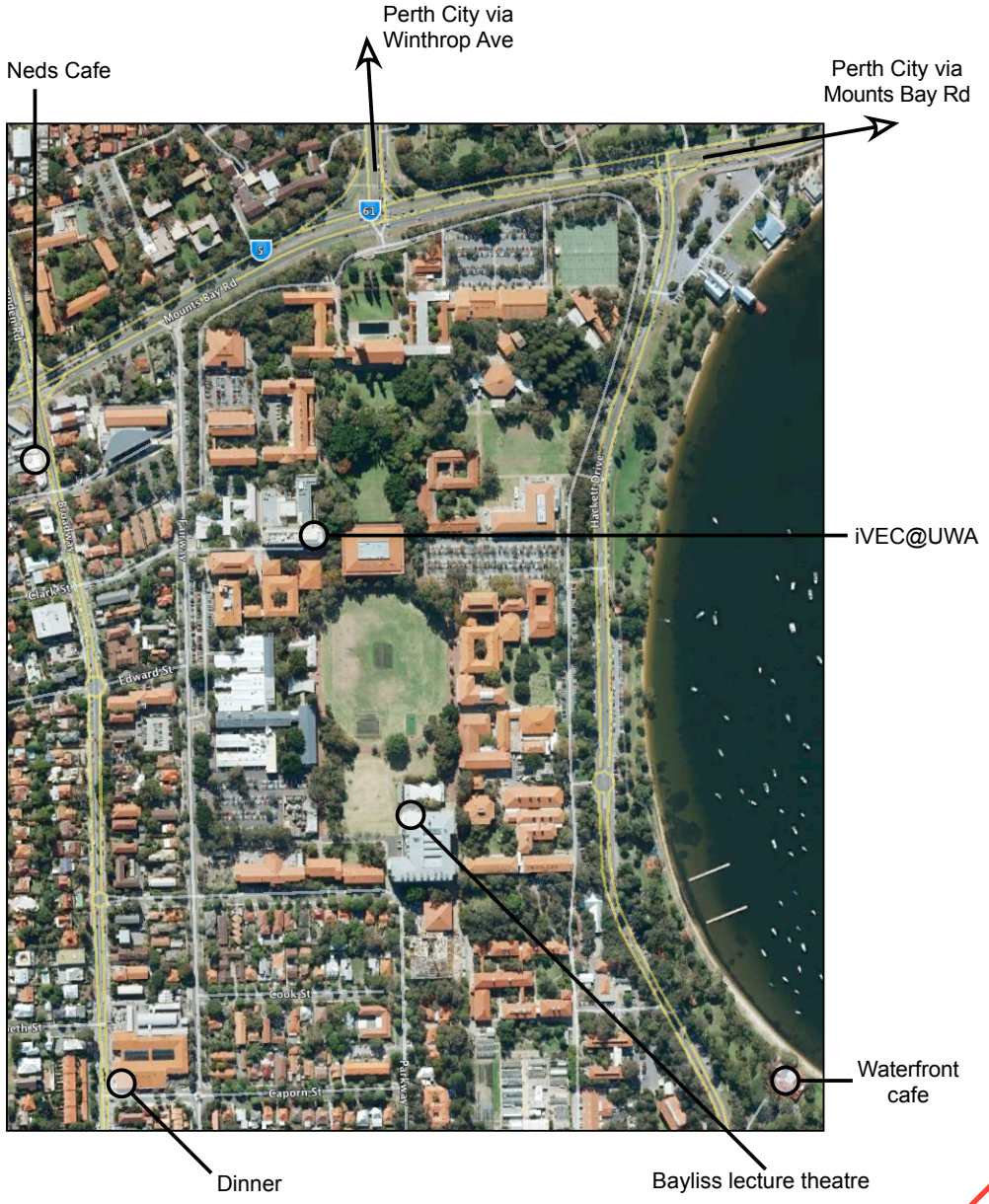
All registered attendees are welcome to join us for dinner on the evening of **December 6th @ 6.30pm** at **Sabz Cafe** at **Broadway Fair, 39/88 Broadway St**, Crawley.

TRANSIT

All of the major services use the bus stops on Stirling Highway at the north end of the Crawley Campus, except for the **97** (Subiaco Shuttle) that stops at the north end of Fairway.

Consult the **TransPerth** journey planner for a custom itinerary specifically for your trip:

http://www.transperth.wa.gov.au



KEYNOTE SPEAKERS

W/Prof Klaus Regenauer-Lieb [UWA]

Digital Rocks: From Image Modelling to Geology

Professor Regenauer-Lieb joined The University of Western Australia (UWA) and the CSIRO Division of Earth Science and Resource Engineering (CESRE) as the Western Australian Premier's Research Fellow on Computational Earth System Dynamics in 2006

Professor Regenauer-Lieb's work over the past decade has focused on developing a self-consistent view on how the planet Earth works from an integrated mechanical-thermal-chemical viewpoint.

Processes on the Earth span length scales ranging from the atomic to the planetary scale and time scales ranging from lattice vibrations to the age of the Earth. This makes the development of a self-consistent approach particularly challenging, however, it is at the forefront of many modern developments in solid and

Dr. Alan Duffy [ICRAR / UMelb]

Visualising the Invisible: Simulating the Cosmological Universe

Dr. Alan Duffy is a theoretical astrophysicist and cosmologist, working on the formation of galaxies, the properties of Dark Matter and measuring the larger scale nature of the Universe. To study the evolution of galaxies and the interaction with Dark Matter, he runs billion-particle simulations on supercomputers around the world. This has resulted in numerous refereed research articles, public interviews and presentations at both Universities/Conferences and public outreach events ranging from planetarium shows to pubs.

Dr. Duffy is recognised for his enthusiasm, communication skills, insight, and is well- respected for his contribution to astronomy research and outreach in Australia and Europe. He retains strong international links in the form of his membership with the world-wide OWLS collaboration as well as being a co-investigator in two top rated surveys on the next-generation Australian Square Kilometre Array Pathfinder.

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Thursday 6th December 2012

Time		Presenter	Topic
8.45		**Welcome & Introduction**	
9.00	Keynote	Klaus Regenauer-Lieb, UWA	Digital Rocks: From Image Modelling to Geology
9.30			-- Questions & Changeover
9.40		Jie Liu, CSIRO	Applications of Microtomography on Geosciences
10.00			-- Questions & Changeover
10.10 - 10.40		**Morning Tea**	
11.05		David G. Barnes, Monash	Surfer: Simple, Interactive, Cross-Platform, Multi-Surface Rendering
11.25			-- Questions & Changeover
11.35		Alf Uhlherr, CSIRO	The CSIRO eResearch Visualisation Service
11.55			-- Questions & Changeover
12.05		Paul McIntosh, VPAC/Monash	Adventures with VTK - A Journey from Mesh to Pixel
12.25			-- Questions & Changeover
12.35 - 1.35		**Lunch Break**	

Thursday 6th December 2012

Time		Presenter	Topic
12.35 - 1.35		**Lunch Break**	
1.35	Keynote	Alan Duffy, ICRAR/UMelb	Visualising the Invisible
2.05			-- Questions & Changeover
2.15		John Goldsmith, ICRAR/Curtin	Cosmos, Culture and Landscape
2.35			-- Questions & Changeover
2.45		Wojtek James Goscinski	MASSIVE and the Characterisation Virtual Laboratory
3.05			-- Questions
3.15-3.45		**Afternoon Tea**	
3.45		Tomasz Bednarz, CSIRO	Demoscene 2012: Updates and Highlights
4.00			-- Questions & Changeover
4.10		Chuong Nguyen, CSIRO	Kinect Sensor Noise Modeling to Improve 3D Reconstruction
4.35			-- Questions & Changeover
4.45		Eleanor Gates-Stuart, CSIRO	StellrScope: An Interdisciplinary Art and Science Project
5.05			-- Questions & Changeover
5.15		**Wrap-Up**	

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SCHEDULE

Friday 7th December 2012

Time	Presenter	Topic
8.45	**Introduction & Welcome**	
9.00	Paul Bourke, iVEC@UWA	Automated 3D Reconstruction from Photographs.
9.30		-- Questions & Changeover
9.40	Ajay Limaye, ANU	3D Printing of Computed Tomography Data
10.00		-- Questions & Changeover
10.10 - 10.40	**Morning tea**	
11.05	Andrew Squelch, iVEC/Curtin	Turning Back Time with VTK !
11.25		-- Questions & Changeover
11.35	Michael de Hoog, Geoscience Aus	Developments in Visualisation at Geoscience Australia
11.55		-- Questions & Changeover
12.05	Stuart Ramsden, ANU	Colouring Air and Water: Visualisation in the Earth Sciences
12.25		-- Questions & Changeover
12.35 - 1.35	**Lunch break**	

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SCHEDULE

Friday 7th December 2012

Time	Presenter	Topic
12.35 - 1.35	**Lunch Break**	
1.35	Peter Kovesi, UWA	Interactive Multi-Image Blending for Data Vis and Interpretation
2.05		-- Questions & Changeover
2.15	Syed MS Islam, UWA	Visualisation in the Treatment Planning of Obstructive Sleep Apnea
2.35		-- Questions & Changeover
2.45	Andreas Lee, RBWH	Medical Ultrasound: Advances and Problems in 3D Imaging
3.05		-- Questions
3.15-3.45	**Afternoon Tea**	
3.45	Tomasz Bednarz, CSIRO	Demoscene 2012: Updates and Highlights
4.00		-- Questions & Changeover
4.10	Christian Stolte, CSIRO	Designing and Building Web-Based Visualisation Tools for Biology
4.35		-- Questions & Changeover
4.45	Jeremy Rodriguez, McGill Univ.	Visualization of Quantum Walkers: qwViz
5.05		-- Questions & Changeover
5.15	**Wrap-Up**	

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ABSTRACTS

Applications of Microtomography on Geosciences

Jie Liu, CSIRO

Using microtomography of rocks, we characterize microstructures of geometry, simulate material properties on micro-scale, and extract parameters of scaling laws for upscaling of properties.

We characterise a microstructure by its volume fraction, the specific surface area, the connectivity (percolation) and the anisotropy of the microstructure. Petro-physical properties (permeability and mechanical parameters) are numerically simulated based on representative volume element (RVEs) from microstructural models. The size of RVEs is prerequisite for these forward simulations. We use stochastic analyses of structures to determine the size of a geometrical RVE, and upper/lower bound finite element computations of a series of models with different sizes to determine a mechanical RVE. Upscaling of properties is achieved by means of percolation theory. We detect the percolation threshold by using a shrinking/expanding algorithm for our static micro-CT images of rocks. Other parameters of scaling laws can be extracted from quantitative analyses and/or numerical simulations on the original micro-CT images and the derivative models of shrinking/expanding. Scaling laws describe the possibility and conditions of properties determined at micro-scale to be effective on larger scales. Examples demonstrating the applications include two heated rock samples showing the development of thermal cracks, a fully analyzed synthetic sandstone sample, and a newly processed carbonate sample on mechanical properties.

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ABSTRACTS

Surfer: Simple, Interactive, Cross-Platform, Multi-Surface Rendering

David G. Barnes, Monash

The interactive visualisation of surfaces is a critical comprehension-building activity in science, yet it remains difficult to publish and share such visualisations in a common, simple environment integrated with standard publishing modes (PDF, Web). A concise, practical method for sharing multi-surface models, viewable "in situ" (e.g. in a PDF, in a web browser, on an iPad), would find extensive applications in research and education.

We propose such a method, and demonstrate a prototype multi-surface viewer, based on the Alias Wavefront OBJ format, and a simple descriptive text file ("token file") that brings multiple OBJ surfaces together, with potential for naming, grouping and per-component shading. We have developed code ("*surfer") which, from the same token file, can create (1) WebGL-, (2) PDF-, and (3) iPad-based 3-d visualisations, all providing interactive control of viewing angle, selective display of the grouped components, and interactive labelling of clicked (touched) components.

The visualisations are nearly identical in appearance, with minor differences due to the closed nature of the lighting model in the 3-d-capable PDF display applications (Adobe Reader and Adobe Acrobat). We present examples from two significant application areas: anatomy and neuroimaging. In anatomy, 3-d surface models generated from segmentation of imaging data, or from histological examination, routinely have multiple components (e.g. bones, muscles, nerves) which overlap and conceal each other. Grouping the components by tissue type, functional group, and/or layer depth, can yield a highly instructive visualisation that provides significant physical insight to, and understanding of, the specimen being studies. Click, and especially touch, to identify individual anatomical components is a compelling usability experience.

In neuroimaging, it is commonplace to paint measured functional activations onto the highly-folded 2-d sheet of the cerebral cortex.

Traditionally, these activations are shown in static figures, with the cortex inflated to a smooth, colour-shaded sphere, so as to prevent self-occlusion of activation signals. Surface inflation is undesirable since it modifies important biophysical properties (e.g. curvature, depth, thickness) of the surface, and imparts an abstraction away from the true physical relationship between different sites on the surface, necessitating the development and use of cortical surface atlases instead of structural "volume" atlases. A 3-d visualisation of the cortical surface in its natural folded state, with colour-coded functional activations that can be selectively applied, offers a vastly superior mechanism to explore and understand, at least qualitatively, the structure of functional activity recorded by neuroimaging studies.

ABSTRACTS

The CSIRO eResearch Visualisation Service: Overview and Current Status

Alf Uhlherr, CSIRO

The CSIRO eResearch Program develops services that use advanced ICT to collect, model and analyse large and complex datasets. The Visualisation Service is one component of that Program, providing high-end visualisation capabilities.

The Visualisation Service capabilities include:

- Remote Visualisation
- Tiled Display Systems
- Stereoscopic Display Systems
- Visualisation Application Support

In this presentation, we briefly describe these capabilities and provide an assessment of their uptake across different research applications, their perceived usefulness and future directions.

Adventures with VTK: A Journey from Mesh to Pixel

Paul McIntosh, VPAC / UMelb

The Visualization Toolkit (VTK) is an open-source, freely available software system for 3D computer graphics, image processing and visualization. Presented is an overview of VTK, followed by an experience report of applying VTK to manipulating STL (STereoLithography) meshes and generating large scale data visualisations.

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ABSTRACTS

Cosmos, Culture and Landscape: Exploring Australian Aboriginal Cultural Astronomy with Digital Imaging

John Goldsmith, ICRAR / Curtin

Australian Aboriginal cultural knowledge of the night sky is an ancient and living body of knowledge, which is increasingly being shared and communicated within Aboriginal and non-Aboriginal communities. Highly successful scientific and Aboriginal community collaborations have arisen out of the development of major radio astronomy developments in Western Australia (including the Murchison Radio Observatory, Australian SKA Pathfinder and Murchison Widefield Array).

One example is "Ilgarijiri", Things Belonging to the Sky", in which Aboriginal knowledge of the night sky from the Murchison region (Western Australia) is shared and expressed via internationally exhibited art exhibitions. My PhD research has investigated this and other key examples of the documentation, communication and sharing of Aboriginal knowledge of the night sky, including locations such as Kandimalal (Wolfe Creek Meteorite Crater, East Kimberley), Wave Rock, Mulka's Cave, Murchison Widefield Array, and a night sky inspired Dreamtime monument at Claisebrook, Perth.

Digital imaging, including timelapse and 360 degree photography has been applied in this PhD research, to record the visual context, and in some cases, the astronomical context, of these important landscapes. These visual resources have been developed into a virtual tour, which now enables audiences to visually experience landscapes and to encounter Aboriginal cultural perspectives of the night sky that link the landscape with the cosmos.

ABSTRACTS

MASSIVE and the Characterisation Virtual Laboratory

Wojtek James Goscinski, MASSIVE

The Multi-modal Australian ScienceS Imaging and Visualisation Environment (MASSIVE) is a specialised Australian HPC facility for computational imaging and visualization. As part of its program, MASSIVE (through Monash University) is developing research infrastructure software as part of the $3.2M Characterisation Virtual Laboratory (CVL).

This presentation will introduce the MASSIVE and CVL projects, and their program of work. In particular, it will focus on how these projects are helping researchers to process, analyze and visualize instrument data by integrating instruments, and providing researchers access to a remote desktop environment.

Kinect Sensor Noise Modelling to Improve 3D Reconstruction

Chuong Nguyen, CSIRO

Fast and accurate 3D reconstruction from depth data requires realistic model of sensor error/noise. We found that existing works on Kinect sensor noise do not describe the complete noise characteristics. We therefore derive a novel Kinect noise model empirically from experimental depth data. Particularly, we obtain both lateral and axial noise distributions as functions of both distance and observed surface angle. To demonstrate the effectiveness of the Kinect noise model in improving the accuracy of 3D reconstruction, we apply the model to the KinectFusion system. To incorporate the new Kinect noise model, we extend depth filtering, volume fusion and pose estimation of the KinectFusion processing pipeline. Qualitative and quantitative results show that KinectFusion with our noise model significantly produces finer details and more accurate camera tracking than existing KinectFusion algorithm.

ABSTRACTS

StellrScope
Eleanor Gates-Stuart, CSIRO

StellrScope, an interdisciplinary art and science project in connecting the Canberra region to Australia's major crop, wheat, from the times of William Farrer through to the modern era.

Artist, Eleanor Gates-Stuart will discuss the progress of her residency at CSIRO's Transformational Biology Capability Platform and Food Futures Flagship, sharing her experience and creative challenges of interdisciplinary practice and science communication. As part of her interest in 3D reconstruction of insects and wheat, she has been collaborating with Dr Chuong Nguyen and Dr Xavier Sirault in looking at 3D scanning techniques to create new artworks and communicating science to public. She will be showing images from her work in progress.

http://www.stellrscope.com

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ABSTRACTS

Automated 3D Reconstruction from Photographs

Paul Bourke, iVEC@UWA

Presented here, in the form of case study examples, are the results from a number of exercises to practically explore the state of the art of automatic 3D reconstructions and the subsequent visualisation of the results. A number of applications at UWA for automatic 3D reconstruction from photographs have been identified. These include the population of game engines with textured models (as opposed to manually created models involving artistic interpretation), creation of virtual worlds with realistic models without the need for time consuming manual modeling, and generating databases of 3D models for research and documentation in archaeology and virtual heritage.

3D Printing of Computed Tomography Data

Ajay Limaye, ANU

3D printers are becoming more readily accessible. Volumetric data from CT scanners is being produced for many different fields in science and engineering. There are many software programs that generate surface mesh from volumetric data suitable for 3d printing, but none of these produce a coloured textured mesh. This presentation describes coloured mesh generation from volumetric data. A way of texturing surface with subsurface details will also be presented. The surface mesh so generated closely resembles the direct volume rendered image of the same dataset. This mesh generation technique is implemented in open source software package Drishti.

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ABSTRACTS

Turning Back Time with VTK!

Andrew Squelch, iVEC / Curtin

The age of rocks can be estimated using the technique of (U–Th)/He thermochronology, which is based on measuring the quantity of Helium, Uranium and Thorium present in certain crystal grains (i.e. zircon and apatite) found in the rocks of interest. However, an underestimate of the rock's age can occur because some of the Helium, arising from the decay of the Uranium and Thorium in the outer 20 μm of the crystal grains, escapes from the gains and is not quantified. A correction factor (FHE) based on estimated surface area and volume for assumed grain shapes (i.e. sphere, prolate spheroid and tetragonal prism) is applied to adjust for this error in rock age determination. Traditionally the physical dimensions of the crystal grains are measured by hand under a microscope but these tend to be subjective and do not fully account for the unique shapes of the crystal grains. Hence, the need for a more objective and precise method of calculating the FHE correction factor, which ultimately led to the use of microtomography and the visualisation, image processing and quantification features of the Visualisation Toolkit (VTK). In many cases the resulting FHE correction factors led to rocks being classified as several million years older than originally determined.

Developments in visualisation at Geoscience Australia

Michael de Hoog, Geoscience Aus

Over the past four years Geoscience Australia has developed a suite of tools to visualise geoscience data in a 3D globe context. Built on the NASA World Wind Java SDK, these tools were released to the open source community in early 2012. This presentation will focus on some recent developments of these tools, including support for global-scale volumetric datasets and 3D models, and a keyframe animation system that is used to generate dynamic flythough animations. Together, these tools allow geoscience data visualisations to be incorporated into larger video works or presentations and made easily accessible via the web. Currently the tools provide an effective mechanism for communicating geoscience data to a range of stakeholders including scientists, politicians and the general public. This presentation will also discuss future development intended to provide a more stable and reuseable platform.

ABSTRACTS

Colouring Air and Water: Visualisation in the Earth Sciences

Stuart Ramsden, ANU

Using recent examples of visualisation in Oceanography and Atmospheric research, we look at the design constraints involved in choosing appropriate colour palettes for the display of scientific data. We also show how different patterns in the data are revealed by changing only the colour map.

Interactive Multi-Image Blending for Data Visualisation and Interpretation

Peter Kovesi, UWA

The need to integrate data from images of different modalities is an increasingly common problem for a wide range of disciplines ranging from the geosciences through to medicine. Interactive multi-image blending is presented as a tool for facilitating the interpretation of complex information from multiple data sources. Traditionally, image blending has only been considered for cross-dissolving effects between two images. We present a family of different image blending techniques that support the blending of multiple images under a range of different situations. For image blending to be a useful tool for multiple image interpretation it is important that the input images remain distinct within the blend. We argue that interactivity of the blend is an important component for achieving this. Blending can also be usefully employed to interactively explore parameter variations for enhancement techniques. Often the best parameter values to use cannot be known beforehand, and it is common for different regions of an image to require different parameter values for best enhancement.

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ABSTRACTS

Visualisation in the Treatment Planning of Obstructive Sleep Apnea

Sved MS Islan, UWA

Obstructive Sleep Apnoea (OSA) is a serious sleeping disorder with significant public health implications. Apart from the excessive day-time sleepiness and fatigue, OSA patients suffer with other health complexities that lead to on-road and work-related accidents. In Australia, OSA related financial and non-financial cost is estimated billions of dollars per year. Although Maxillomandibular Advancement (MMA) surgery is often advised as the last line of treatment, it is the only permanent solution to OSA with definitive outcome especially for the patients with significant facial deformation or anomalies. Since MMA is expensive, irreversible and involves significant changes in the facial appearance, it will be very helpful for the patients and surgeons to predict and visualize the expected outcome prior to the surgery. We propose to perform 3D analysis of the facial surface data, fluid-flow analysis on the airway segmented form volume image data and soft-tissue deformation analysis in order to predict the required physiological changes to ensure optimal airflow through the airway. The overall predicted facial morphological changes will then be visualized using 3D Computer Graphics-based techniques for the evaluation of the patients and surgeons.

Designing and Building Web-Based Visualisation Tools for Biology

Christian Stolte, CSIRO

After a twenty-year career in graphic design and web development I joined the Broad Institute of MIT and Harvard in 2007 to design websites and visualisations for genomic data. Now based at CSIRO in Sydney, I work in a group whose focus is to build web-based visualisation tools for biology. I will talk about the role design plays in communicating and making sense of scientific data. I will highlight a few key scientific projects:

- The Tuberculosis Database (www.tbdb.org)
- MEDEA: a suite of flash-based genome visualisation tools
- A viral genome viewer
- Aquaria: a protein structure matching engine
- VIZBI+: visualising the future of biomedicine

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ABSTRACTS

Medical Ultrasound - Advances and Problems in 3D Imaging

Andreas Lee, RBWH

Ultrasound imaging with 3D rendering has been available since early 90's. It has become a main marketing feature. Although paramedical services like prenatal babyfacing are common numbers of routine clincial applications are small. Problems arise from various areas: Operator dependency, Ultrasounds inherited limitations (resolution, tissue registration), Artifacts, Dynamic ultrasound imaging, User interface, Proprietary data format, Sampling and processing time, Conversion volumetric to surface. Examples will be given to each point.

Visualization of Quantum Walkers: qwViz

Jeremy Rodriguez, McGill Univ.

Quantum walkers are the quantum analogue to the classical random walk. Quantum walkers have found use in many application that their classical counter part have been used for, they have as well started to find use in new novel areas such as in protein folding and in biological process e.q. photosynthesis. As more applications for quantum walkers are found the need to be able to meaningfully and efficiently visualize the dynamics of the system becomes more important. This provides the challenges of efficiently showing the probability on the nodes of the graph and how they change with time. When multiple walkers are introduced on the same graph then extra challenges are introduced as more then one probability distribution needs to be shown on the graph. Here we will show an application that we have developed so as to be able to visualize walkers on a graph as well as other useful quantities of the system.

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